

Web based Trouble Report system

3 parts of trouble report system

1. Report trouble
2. Fix problem
3. Analyze data

Form for reporting trouble

Trouble Report system home page

DIII-D Trouble Report Database

[Submit](#) a new Trouble Report

[Respond](#) to a Trouble Report

[Update the down time](#) for a submitted Report

[Review](#) a submitted Trouble Report or [Print](#) a submitted Report

[Review or respond](#) to trouble trouble reports for a specific person.

[See by number](#) a signed-off Trouble Report.

[Summaries](#) of Trouble Reports.

[Login](#) for database maintenance (requires UserID and Password)

[DIII-Operations Website](#) | [Tokamak Operations Website](#) | [GA Fusion Website](#)

Report problem

DIII-D Trouble Report

Group:

Computer Systems ▼

Select a Group

Subgroup:

Subgroup ▼

[Help to find an item](#)

Component:

Component ▼

Description of the problem:

Magnitude of the problem: Prevents Operations ▼

Task Leader: Email:

Cause of trouble: Hardware Failure ▼ Reported by:

Submit

Reset

Date: 3/13/99 Time: 4:07:25 PM Downtime: hours

Help section: If you need help in determining the group or subgroup for a subgroup or component go to [FindItem.asp](#)

Response to problem

DIII-D Trouble Report

TrNo: 5494

Group
I&C

SubGroup
Integrators

Component
Other

Description of the problem:

Integrator for FSF6NB failed and was replaced. Int cal test shot 98512.

Magnitude of the problem: Prevents Operations

Taskleader: Pronko

Cause of trouble: Hardware Failure

Reported by leer on 3/2/99 at 10:50:47 AM.

The assigned downtime is 0.25 hours.

Response:

Subsystem affected

Personnel involved in repair

Status of Repair

Immediate attention ☒ Yes ☐ No

Estimated start of repair Completion date

Repair inspected by

Is the repair permanent? ☒ Yes ☐ No

Is testing required? ☒ Yes ☐ No Date of test

Test complete date

Description of repair

Submit

Reset

DIII-D Operating experience

DIII-D FY99 OPERATIONS SCHEDULE

OCTOBER 98							NOVEMBER 98							DECEMBER 98							JANUARY 99						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
				1	2	3	1	2	3	4	5	6	7			1	2	3	4	5						H	2
4	5	6	7	8	9	10	8	9	10	11	12	13	14	6	7	8	9	10	11	12	3	4	5	6	7	8	9
11	12	13	14	15	16	17	15	16	17	18	19	20	21	13	14	15	16	17	18	19	10	11	12	13	14	15	16
18	19	20	21	22	23	24	22	23	24	25	H	H	28	20	21	22	23	C	H	26	17	18	19	20	21	22	23
25	26	27	28	29	30	31	29	30						27	H	C	C	H			24	25	26	27	28	29	30
FEBRUARY 99							MARCH 99							APRIL 99							MAY 99						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
31	1	2	3	4	5	6		1	2	3	4	5	6					1	2	3							1
7	8	9	10	11	12	13	7	8	9	10	11	12	13	4	5	6	7	8	9	10	2	3	4	5	6	7	8
14	15	16	17	18	19	20	14	15	16	17	18	19	20	11	12	13	14	15	16	17	9	10	11	12	13	14	15
21	22	23	24	25	26	27	21	22	23	24	25	26	27	18	19	20	21	22	23	24	16	17	18	19	20	21	22
28							28	29	30	31				25	26	27	28	29	30		23	24	25	26	27	28	29
June 99							July 99							August 99							September 99						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
30	H	1	2	3	4	5					1	2	3	1	2	3	4	5	6	7				1	2	3	4
6	7	8	9	10	11	12	4	H	6	7	8	9	10	8	9	10	11	12	13	14	5	H	7	8	9	10	11
13	14	15	16	17	18	19	11	12	13	14	15	16	17	15	16	17	18	19	20	21	12	13	14	15	16	17	18
20	21	22	23	24	25	26	18	19	20	21	22	23	24	22	23	24	25	26	27	28	19	20	21	22	23	24	25
27	28	29	30				25	26	27	28	29	30	31	29	30	31					26	27	28	29	30		

Definition of Availability

The tokamak is pulse on average every 13.5 minutes. If the tokamak is not fired within a 15 minutes interval, 15 minutes of downtime is charged to the entity that caused the downtime.

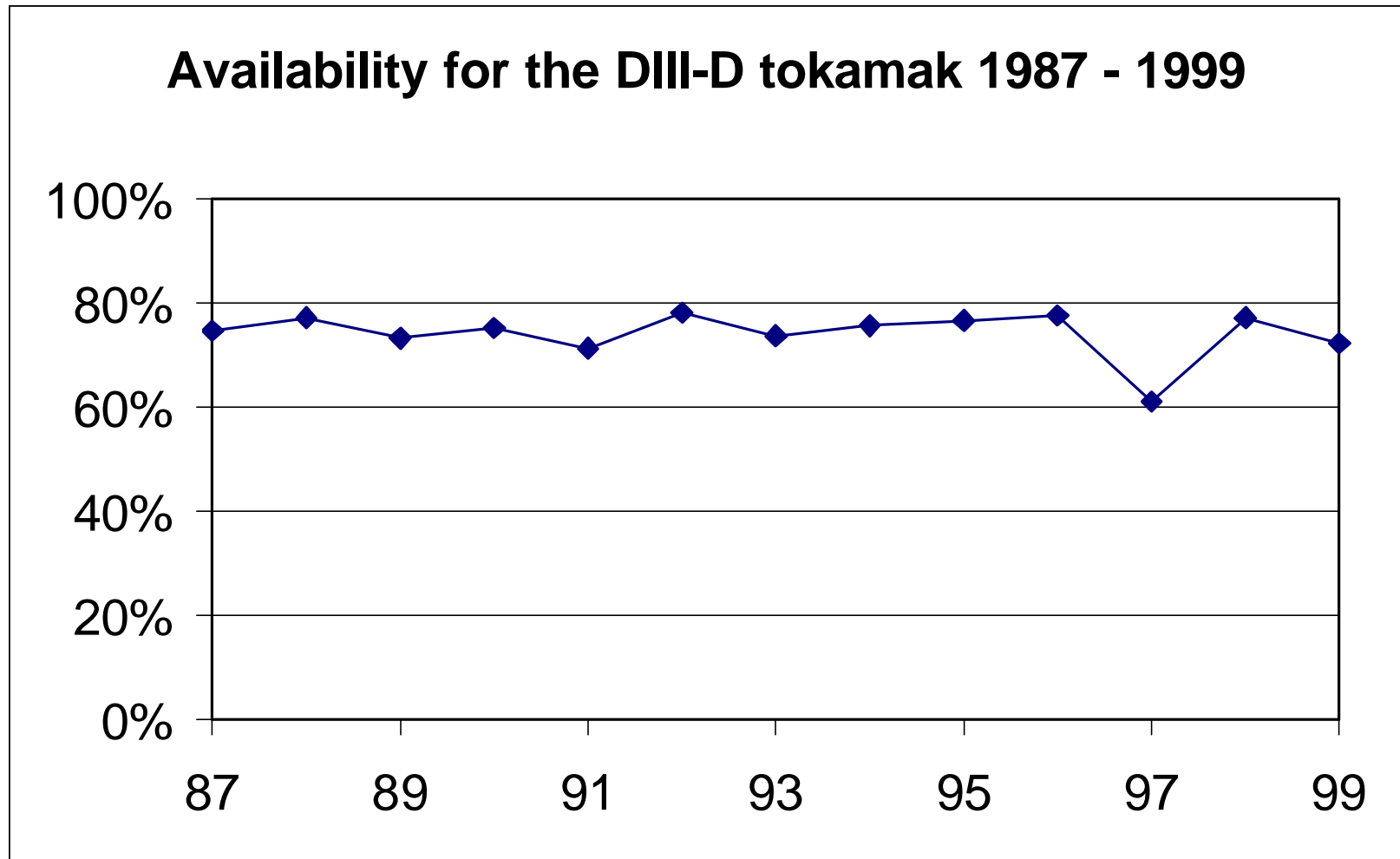
If a shot is fired, but it is of no value to the scheduled experiment 15 minutes of downtime is charged to the diagnostic or equipment that made the shot worthless for the scheduled experiment.

Availability is defined as $(\text{scheduled time} - \text{downtime})$ divided by the scheduled time.

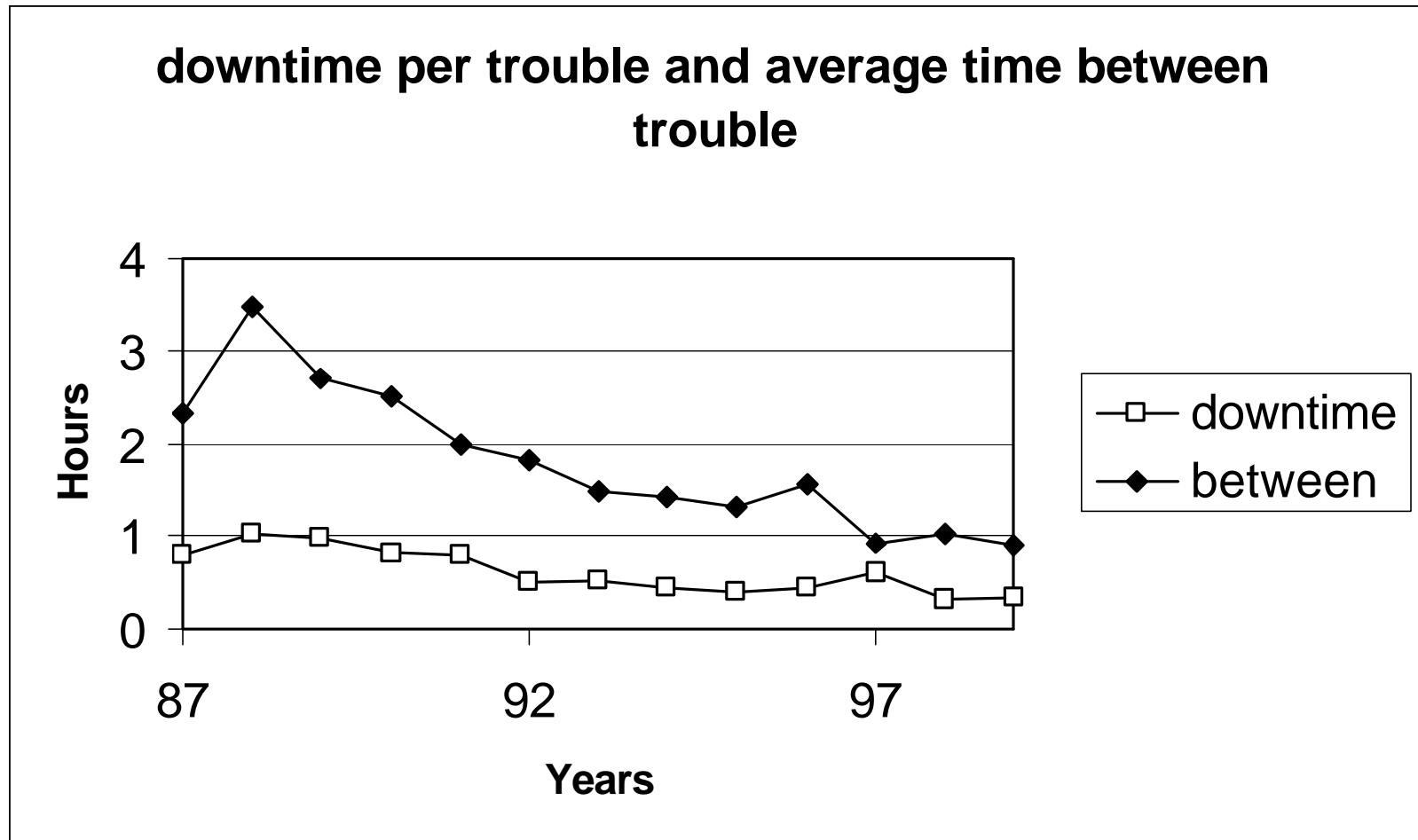
DIII-D Availability

Year	Days Sch	Hours Sch	Act. Hrs	Avail.	No shots	shots/day	shots/hour
FY91	111	883.00	625.75	71%	2786	25	4.5
FY92	69	563.25	439.75	78%	1861	27	4.2
FY93	83	665.50	476.25	72%	2107	25	4.4
FY94	47	393.00	295.25	75%	1396	30	4.7
FY95	70	601.75	470.75	78%	2212	32	4.7
FY96	83	708.25	550.00	78%	2435	29	4.4
FY97	61	527.50	299.75	57%	1274	21	4.3
FY98	78	675.25	511.75	76%	2224	29	4.3
Total	602	5017.50	3669.25	73%	16295	27	4.4

Availability of the DIII-D tokamak has been fairly constant over the years.



The average downtime for trouble and the average time between troubles have decreases over the years, even though the facility has become more complex.



Analysis of Data

Summary of Trouble Reports
for the period 5/19/87 - 9/7/99.

GroupID	Group	Total	Downtime
1	Power Systems	1232	849.25
3	Tokamak Operations	641	607.96
9	Vacuum and Fluids	399	302.65
2	Computer Systems	445	173.05
5	Physics	265	110.40
7	I&C	292	110.05
6	Diagnostics	177	78.15
4	Neutral Beams	174	55.40
13	DIII-D Coordination	36	37.50
14	Safety	95	18.50
15	High Voltage Power Supplies	44	17.75
17	ECH	34	16.75
8	ICH	14	14.00
12	DIII-D facility	28	8.25
11	Other	20	6.25
16	Mechanical Engineering	6	3.25

A total of 3902 trouble reports with a total down time of 2409.16 hours been filed for the period 5/19/87 - 9/7/99.

Downtime for the different subgroups

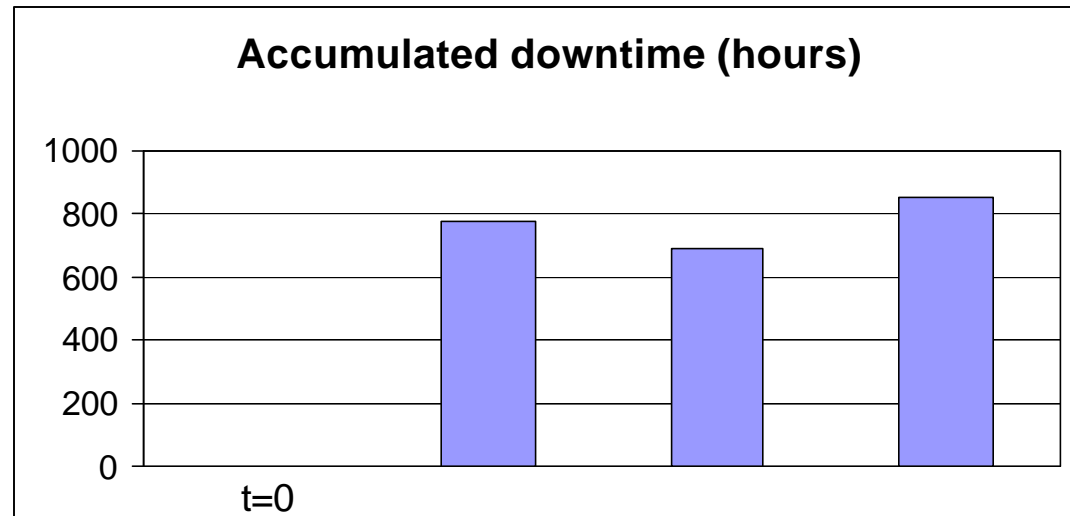
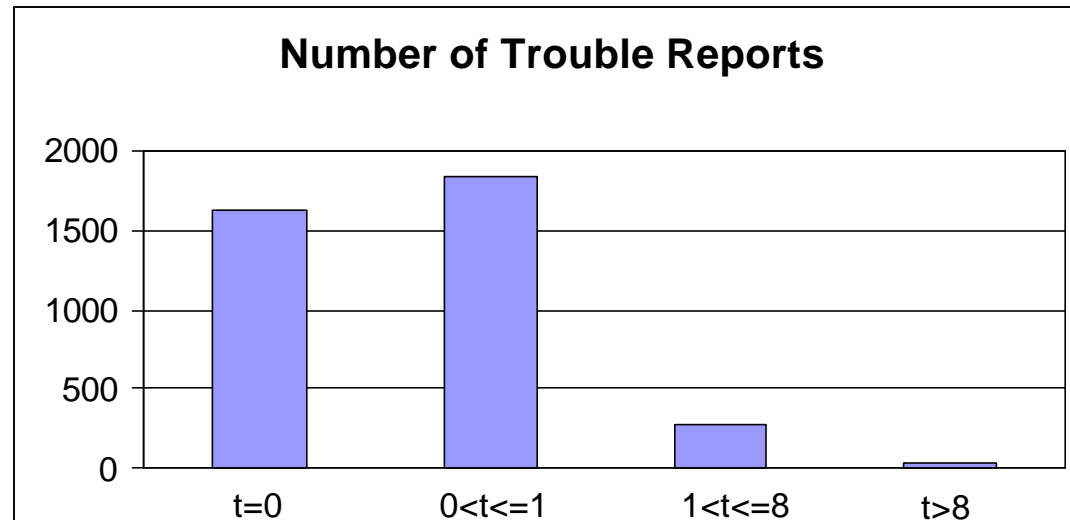
For the period 5/19/87 - 9/7/99.

Subgroup	Group	Downtime	Number of TRs
E coil	Tokamak Operations	241.05	5
B Power supply	Power Systems	166.95	209
B coil	Tokamak Operations	144.20	21
Water System	Vacuum and Fluids	112.00	113
AC power	Power Systems	96.50	23
HX choppers	Power Systems	92.30	160
Switches	Power Systems	85.75	56
E Power supply	Power Systems	81.75	152
PCS	Physics	68.45	166
X Choppers	Power Systems	65.50	165
Control Computer	Computer Systems	53.75	130
Cryo	Vacuum and Fluids	53.00	65
Data Acquisition	Computer Systems	52.80	151
CAMAC	I&C	51.55	84
DIII-D Vacuum	Vacuum and Fluids	49.65	32
D2 Power supply	Power Systems	48.50	37
MG2	Power Systems	46.25	51
Thomson Scattering	Diagnostics	46.05	87
AWCS	Vacuum and Fluids	42.00	34
EPSSIC	Tokamak Operations	37.81	72
Setup	Physics	35.70	78

Downtime for components

Component	SubGroup	Group	Downtime (hrs)	CountOfTr	Single event (hrs)
Other	E coil	Tokamak Operations	241.05	5	240
Other	AC power	Power Systems	96.5	23	80
B coil belt bus	B coil	Tokamak Operations	91.2	6	70
S1/S2	Switches	Power Systems	68.25	28	40
SCRs	B Power supply	Power Systems	61.45	68	30
Other	PCS	Physics	61.05	145	2
Other	Data Acquisition	Computer Systems	50.55	143	2.5
Other	E Power supply	Power Systems	50	91	15
Other	Water System	Vacuum and Fluids	48.5	35	18
Leak	DIII-D Vacuum	Vacuum and Fluids	47.65	23	10
Other	Cryo	Vacuum and Fluids	46.75	46	24
Other	Control Computer	Computer Systems	45.5	97	5.5
Other	CAMAC	I&C	44.8	70	3.5
Gate Drive Board	B Power supply	Power Systems	38.75	18	18
Ground fault	B coil	Tokamak Operations	38.5	5	28.5
Other	MG2	Power Systems	38.25	45	6
Other	B Power supply	Power Systems	37.25	78	4.25
Other	EPSSIC	Tokamak Operations	34.31	70	4.5
Other	Setup	Physics	33.7	71	2
Other	Other	Tokamak Operations	33.6	41	24
Ceramic breaks	AWCS	Vacuum and Fluids	33.5	6	11
Other	D1 Power supply	Power Systems	26.75	43	5.5
Other	D2 Power supply	Power Systems	26.5	26	12

A few problems (33) accounts for more than 1/3 of the downtime.



The downtime and number of trouble reports are dependent on the size of the power supply and how much they are stressed.

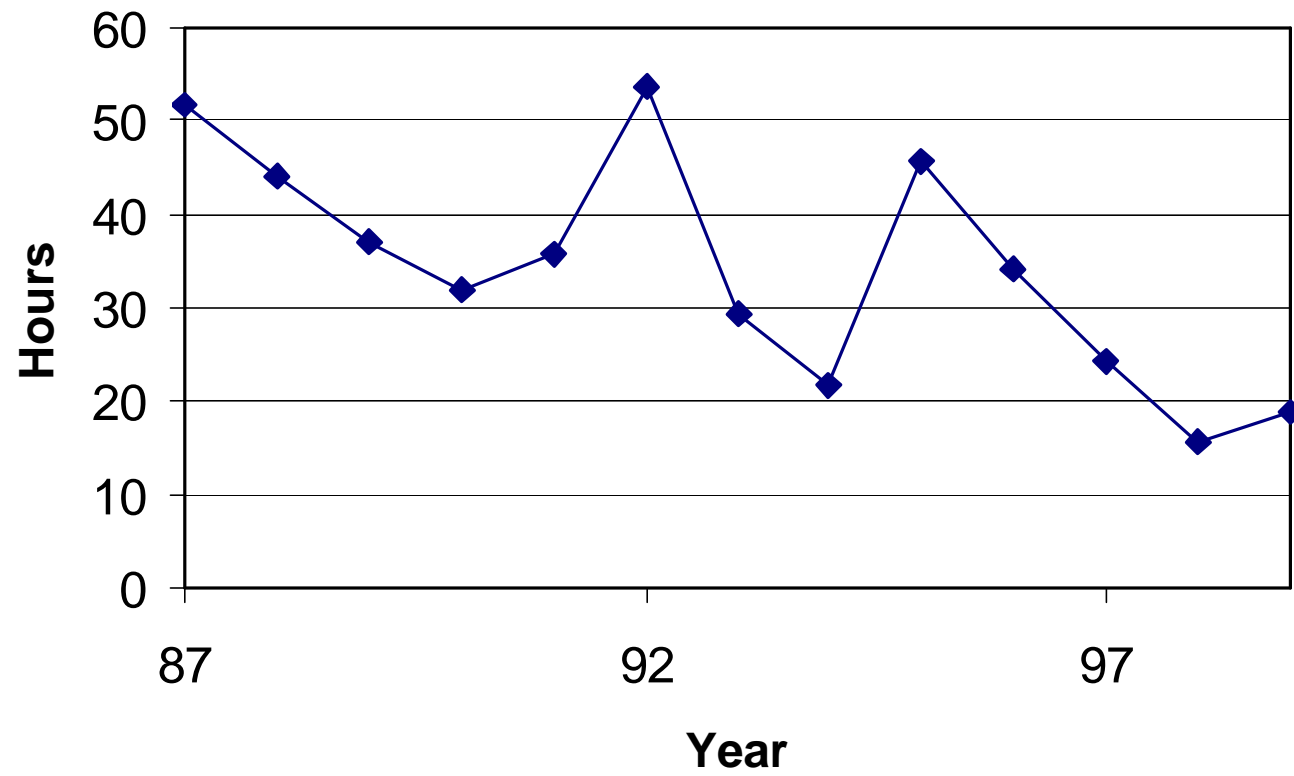
SubGroup	Max Power (MW)	Downtime (hrs)	CountOfTr
B Power supply	127	152	193
E Power supply	290	75	144
D2 Power supply	8	49	37
D1 Power supply	5	29	48
HV2 Power supply	24	27	29
HV1 Power supply	24	15	39
T2 Power supply	4	12	32
V1 Power supply	7	11	41
T1 Power supply	4	9	26

The E power supply is only used at half its capability.

SCR failures

Year	Downtime (hrs)	Number of TRs	Downtime (hrs) per TR	Hours of actual ops	Average time between failures (hrs)
91	3.75	8	0.46	625.75	78
92	0	0	0	439.75	
93	1.75	6	0.29	476.25	79
94	1.75	5	0.35	295.25	59
95	0.5	2	0.25	470.75	235
96	2	6	0.33	550.00	92
97	15.25	8	1.9	299.75	37
98	8.5	8	1.06	511.75	64
Total	33.5	43	0.78	3669.25	85

Mean time between SCR failure



HX power conditioning units

Year	Downtime (hrs)	Number of TRs	Downtime (hrs) per TR	Hours of actual ops	Average time between failures (hrs)
91	3.75	11	0.34	625.75	57
92	4.00	6	0.66	439.75	73
93	8.25	17	0.48	476.25	28
94	2.25	5	0.45	295.25	59
95	4.00	8	0.50	470.75	59
96	4.75	11	0.43	550.00	50
97	19.50	9	2.16	299.75	33
98	23.75	23	1.03	511.75	22
Total	70.25	90	0.78	3669.25	41

Average time between troubles and total downtime for
some groups

Subgroup	Total No.	Downtime (Hours)	Av. Time between TR (Hours)
B Power supply	205	165	32
X Choppers	161	64	41
PCS	160	67	41
HX Choppers	153	89	43
Data Acquisition	151	53	43
E Power Supply	150	77	43

Conclusions

- In spite of increasing complexity we have been able to keep the availability of the DIII-D facility constant. The preventive maintenance program is important.
- The downtime is evenly distributed between major, medium and minor problem. The major problems have to be avoided for a reactor.
- Trouble report system is important to identify problems and find cost effective ways to improve availability.
- A trouble report system should include all troubles, even those that do not cause downtime, but it is hard to enforce.